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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/579,542	05/26/00	LIN	C TSMC2000-079

EXAMINER	
VINH,L	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/579,542	Applicant(s) LIN ET AL.	
	Examiner LAN VINH	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2000* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1, 2, 5, 9, 10, 13, 14, 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In lines 1 and 8 of claim 1, line 1 of claims 5 and 10, lines 1 and 18 of claim 9, line 2 of claim 13, the use of the term "predetermined " is vague and indefinite.

Claims 2, 9, 14, 18 contain the trademark/trade name "black diamond". Where a trademark or trade name is used in a claim as a limitation to identify or describe a particular material or product, the claim does not comply with the requirements of 35 U.S.C. 112, second paragraph. See *Ex parte Simpson*, 218 USPQ 1020 (Bd. App. 1982). The claim scope is uncertain since the trademark or trade name cannot be used properly to identify any particular material or product. A trademark or trade name is used to identify a source of goods, and not the goods themselves. Thus, a trademark or trade name does not identify or describe the goods associated with the trademark or trade name. In the present case, the trademark/trade name is used to identify/describe a low k dielectric material and, accordingly, the identification/description is indefinite.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheung et al (US 6,287,990) in view of Rana et al (US 6,191,026).

Cheung discloses a method for depositing a low k dielectric constant film at low power level. This method comprises the steps of:

depositing a layer of low k oxidized organosilane by plasma enhanced chemical vapor deposition (PECVD) using pulsed low level of RF power at 20 W (col 3, lines 29-48 and col 15, lines 1-3) reads on depositing a first layer of low dielectric constant material by means of PECVD at a first power level

depositing a dielectric layer having low dielectric constant such as FSG (fluorosilicate glass) by PECVD using pulsed level of RF power at 150 W to a thickness of about 5000-10,000 angstroms (col 8, lines 5-9 and col 14, lines 62-65) reads on depositing a second layer of low dielectric constant material by PECVD at a second power level that is higher than the first power level

Unlike the instant claimed invention as per claim 1, Cheung does not specifically disclose repeating the steps of depositing the low dielectric constant material at low and higher power level to reach a thickness of the low dielectric constant material layer.

However, Rana discloses a method for depositing FSG (low k material) layer comprises the step of depositing FSG at low and higher power level to reach the thickness of FSG layer of between 3000-7000 angstroms (col 7, lines 54-68). That reads on repeating the steps of depositing the low dielectric constant material at low and higher power level to reach a thickness of the low dielectric constant material layer

Hence, one skilled in the art would have found it obvious to modify Cheung by adding the step of depositing the low dielectric constant material layer at low and higher power level until reaching a thickness as per Rana because Rana teaches that depositing a FSG (low k material) by the steps using low and higher power level allows deposition of an insulating/dielectric layer for higher aspect ratios (col 11, lines 15-23)

Regarding claim 2, Cheung discloses that low k dielectric films/layer includes fluorinated silicate glass (FSG) , amorphous carbon (col 4, lines 10-17)

Regarding claim 4, Cheung discloses forming an organosilane layer / second layer of low dielectric constant material to a thickness of 200-1000 angstroms (col 15, lines 1-2) reads on the claimed range of 700-1000 angstroms

Regarding claim 5, Cheung discloses depositing the FSG layer to a thickness of about 5000-10000 angstroms (col 15, lines 64-66)

Regarding claim 8, since it is known in the art that oxide /low dielectric constant material has a flat band voltage of –1.82 V exhibiting a low leakage current density , it would have been obvious to one skilled in the art to employ a low dielectric constant material having a flat band voltage that is less than about –3 V to achieve lower leakage current density (see prior art of record)

5. Claims 9- 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheung et al (US 6,287,990) in view of Yew et al. (US 6,159,845) and further in view of Rana et al (US 6,191,026).

Cheung discloses a method for depositing a low k dielectric constant film at low power level. This method comprises the steps of:

depositing a layer of low k oxidized organosilane/ black diamond by plasma enhanced chemical vapor deposition (PECVD) using a gaseous mixture of dimethylsilane, nitrous oxide and helium at pulsed low level of RF power at 20 W to form a layer having a thickness (col 3, lines 29-48 and col 17, lines 1-6) reads on depositing a low power level of black diamond through PECVD from a gaseous mixture of methyl silane and nitrous oxide enhanced by a plasma helium at a power level that is less than about 70 W to form a layer having a thickness

depositing a dielectric layer having low dielectric constant such as FSG (fluorosilicate glass) using a gaseous mixture of dimethylsilane, nitrous oxide and helium at pulsed level of RF power at 150 W to form a layer having a thickness (col 8, lines 5-9 and col 14, lines 62-65) reads on depositing a high power layer of FSG by PECVD at a second power level that is higher than the first power level

patterning and etching the oxidized organosilane/black diamond layer to form a wiring trench (col 15, lines 6-9)

etching and patterning the wiring trench to the substrate/silicon wafer to form interconnect via/contact (col 15, lines 16-18 and fig. 8F)

depositing a copper layer to fill the via hole and trenches (col 15, lines 31-34 and fig. 8 H)

planarizing the structure using CMP leaving copper only inside the trench/via to form dual damascene structure that is free of cracking and peeling (col 15, lines 34-37 and fig. 8H shows a dual damascene structure that has no cracking or peeling)

Unlike the instant claimed invention as per claims 9 and 14, Cheung does not specifically disclose forming a higher power layer of black diamond although Cheung discloses forming a higher power layer of FSG, repeating the steps of depositing the low dielectric constant material at low and higher power level to reach a thickness of the low dielectric constant material layer and the specific deposition time and thickness of the black diamond layer

However, Yew teaches using inorganic dielectric material such as fluorosilicate glass (FSG) or black diamond in a dual damascene interconnect structure (col 4, lines 1-4)

Hence, one skilled in the art would have found it obvious to modify Cheung by substituting the second layer of FSG with black diamond in view of Yew teaching because FSG and black diamond are known inorganic low dielectric material and the substitution of one for the other would have been anticipated to produce an expected result.

Cheung and Yew do not disclose repeating the steps of depositing the low dielectric constant material at low and higher power level to reach a thickness of the low dielectric constant material layer

However, Rana discloses a method for depositing FSG (low k material) layer comprises the step of depositing FSG at low and higher power level to reach the thickness of FSG layer of between 3000-7000 angstroms (col 7, lines 54-68). That reads on repeating the steps of depositing the low dielectric constant material at low and higher power level to reach a thickness of the low dielectric constant material layer

Hence, one skilled in the art would have found it obvious to modify Cheung and Yew by adding the step of depositing the constant material layer at low and higher power level until reaching a thickness as per Rana because Rana teaches that depositing a FSG (low k material) by the steps using low and higher power level allows deposition of an insulating/dielectric layer for higher aspect ratios (col 11, lines 15-23)

Cheung as modified by Yew and Rana do not disclose the specific deposition time and thickness of the black diamond layer.

However, since deposition time and thickness are well known variable in the plasma deposition art which are known to affect the rate and quality of the plasma deposition process , it would have been obvious to select the particular/specific value for the deposition time and thickness through routine experimentations.

Regarding claims 10, 15, Cheung discloses depositing the FSG layer to a thickness of about 5000-10000 angstroms (col 15, lines 64-66)

Regarding claims 11-12, 16-17, Cheung , Yew and Rana do not teach the specific flow rates of the gases. However, in a method of plasma deposition, depositing parameter such as flow rate affect the amount of material deposited on the substrate. It

would have been obvious to adjust the flow rate of the gases by optimizing the same by conducting routine experimentation for the purpose of obtaining the best deposition rate.

Regarding claims 19-20, since Cheung discloses using reactive ion etching /plasma etching to pattern and etch the trench and the via hole and it is known in a method of plasma etching , etching parameters such as flow rate, temp, time affect the amount of material removed by etching. Also, the amount of material removed by etching is known to affect the depth or width of the trench and via hole. Thus, it would have been obvious to adjust the etching parameters by conducting routine experimentations for the purpose of obtaining the specific depth and width of the trench or via hole.

Regarding claims 13 and 18, since it is known in the art that oxide /low dielectric constant material has a flat band voltage of –1.82 V exhibiting a low leakage current density , it would have been obvious to one skilled in the art to employ a low dielectric constant material having a flat band voltage that is less than about –3 V to achieve lower leakage current density (see prior art of record)

6 The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Reber et al (US 6,159,559) discloses oxide/dielectric layer has flat band voltage of –1.82 V (col 7, lines 14-15)

Li et al. (US 6,168,726) discloses that oxidized organosilane is a low k dielectric with a trade name of black diamond (col 3, lines 46-53)

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAN VINH whose telephone number is 703 305-6302. The examiner can normally be reached on Monday-Friday 8:30 -6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, BENJAMIN L UTECH can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 305-3599 for regular communications and 703 305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.

BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

LV
September 19, 2001